WHAT IS CLAIMED IS:

1. A gear driven sprinkler comprising:

a fluid inlet connectable to a source of water;

a rotatable nozzle head having water discharge nozzle;

a fluid powered motor which is driven by the incoming water;

a drive train rotationally coupled to the motor by a motor output shaft and coupled to provide power for rotating the nozzle head; and

a dynamic viscous damping mechanism which cooperates with the drive train to limit the rotational speed of the fluid powered motor.

2. A sprinkler as defined in claim 1, wherein:

the viscous damping mechanism comprises:

a housing including a cavity which surrounds a portion of the drive train;

a viscous medium contained in the hollow cavity; and

the drive train includes a damping member located in the cavity which interacts with the viscous medium to generate a retarding torque that increases with the speed of the motor output shaft.

3. A sprinkler as defined in claim 2, wherein the damping member is located on the output shaft.

4. A sprinkler as defined in claim 2, wherein:

the output shaft extends through the cavity; and

the damping member comprises an enlarged portion which extends longitudinally and radially relative to the shaft in the cavity.

5. A sprinkler as defined in claim 4, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the enlarged portion is sized in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

6. A sprinkler as defined in claim 4, wherein the clearance between the enlarged portion and the inner wall of the cavity is in the range of about 0.005 to about 0.015 inch.

7. A sprinkler as defined in claim 4, wherein the viscosity of the viscous medium is between about SAE 10 and about SAE 70.

8. A sprinkler as defined in claim 4, wherein the viscous fluid has a viscosity of about 500 centistokes.

9. A sprinkler as defined in claim 2, wherein the viscous medium is a silicone fluid.

10. A sprinkler as defined in claim 2, wherein:

the motor output shaft extends through the cavity; and

the damping member comprises a disc mounted on the shaft within the cavity.

11. A sprinkler as defined in claim 10, wherein:

the fluid inlet is connectable to a source of compressed air wherein it is desired to purge water from the sprinkler; and

the disc is sized in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

12. A sprinkler as defined in claim 2, wherein the housing encloses a gear box in the drive train.

13. A sprinkler as defined in claim 2, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the damping member is sized in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

14. A sprinkler as defined in claim 1, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the damping mechanism is sized and configured to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

15. A sprinkler as defined in claim 1, wherein the viscous damping mechanism comprises:

a bearing structure which supports a portion of the motor output shaft;

a hollow cavity within the bearing structure which surrounds the motor output shaft;

liquid-tight seals at opposite ends of the hollow cavity through which the motor shaft passes and which provide support for the motor output shaft;

a viscous medium contained in the hollow cavity; and

a damping member in the cavity coupled to the motor output shaft which interacts with the viscous fluid to apply a retarding torque to the shaft which increases with the shaft speed of the motor so that the water motor lacks sufficient power to overspeed substantially yet at low speed can provide high torque through the power train to rotate the nozzle housing.

16. A sprinkler as defined in claim 15, wherein the damping member is comprised of a plurality of ribs on a part of the shaft located in the cavity which extend longitudinally and radially relative to the shaft.

17. A sprinkler as defined in claim 16, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the shaft and the ribs are sized in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

18. A sprinkler as defined in claim 15, wherein the damping member comprises a disc mounted on the shaft within the cavity.

19. A sprinkler as defined in claim 18, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the disc is sized in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

20. A sprinkler as defined in claim 15, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the damping member is sized and configured in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

21. A gear driven sprinkler as defined in claim 1, wherein:

the fluid powered motor is comprised of:

a turbine having a rotor coupled to the output shaft, a flow directing stator including a plurality of inlet ports which direct a portion of the incoming fluid onto the rotor, a passage for directing the remainder of the water to the nozzle head, a pressure control mechanism for establishing a desired pressure drop across the inlet ports to drive the rotor, and an outlet for directing fluid from the rotor to the nozzle head;

the drive train includes a speed reduction mechanism driven by the output shaft which produces a desired rotational speed for the nozzle head; and

the size and number of the inlet ports, and the established pressure drop are optimized in relation to the braking provided by the damping mechanism to provide a desired low speed torque at the nozzle head for reliable operation.

22. A gear driven sprinkler as defined in claim 21, wherein:

the viscous damping mechanism comprises:

a housing including a hollow cavity which surrounds a portion of the drive train;

a viscous medium contained in the hollow cavity; and

the drive train includes a damping member located in the cavity which interacts with the viscous fluid to generate a retarding torque that increases with the speed of the output shaft.

23. A sprinkler as defined in claim 22, wherein the damping member is located on the output shaft.

24. A sprinkler as defined in claim 22, wherein:

the output shaft extends through the cavity; and

the damping member comprises an enlarged portion which extends longitudinally and radially relative to the output shaft in the cavity.

25. A sprinkler as defined in claim 24, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the enlarged portion is sized in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

26. A sprinkler as defined in claim 24, wherein the clearance between the enlarged portion and the inner wall of the cavity is in the range of about 0.005 to about 0.015 inch.

27. A sprinkler as defined in claim 22, wherein the viscosity of the viscous fluid is between about SAE 10 and about SAE 70.

28. A sprinkler as defined in claim 22, wherein the viscous medium has a viscosity of about 500 centistokes.

29. A sprinkler as defined in claim 22, wherein the viscous medium is a silicone fluid.

30. A sprinkler as defined in claim 22, wherein:
the motor output shaft extends through the cavity; and
the damping member comprises a disc mounted on the shaft within the cavity.

31. A sprinkler as defined in claim 30, wherein:
the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and
the disc is sized in relation to the viscosity of the medium to provide sufficient braking when the turbine is being driven by compressed air to prevent damage due to overspeeding.

32. A sprinkler as defined in claim 22, wherein the housing encloses a gear box in the drive train.

33. A sprinkler as defined in claim 22, wherein:
the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and
the damping member is sized in relation to the viscosity of the medium to provide sufficient braking when the turbine is being driven by compressed air to prevent damage due to overspeeding.

34. A sprinkler as defined in claim 21, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the damping mechanism is sized and configured to provide sufficient braking when the turbine is being driven by compressed air to prevent damage due to overspeeding.

35. A sprinkler as defined in claim 21, wherein the viscous damping mechanism comprises:

a bearing structure which supports a portion of the output shaft;

a hollow cavity within the bearing structure which surrounds the output shaft;

liquid-tight seals at opposite ends of the hollow cavity through which the shaft passes and which provide support for the shaft;

a viscous medium contained in the hollow cavity; and

a damping member on the shaft located within the cavity which interacts with the viscous medium to apply a retarding torque to the shaft which increases with the torque transmitted to the shaft by the turbine.

36. A sprinkler as defined in claim 35, wherein the damping member is comprised of an enlarged portion which extends longitudinally and radially relative to the shaft in the cavity.

37. A sprinkler as defined in claim 36, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the shaft and the ribs are sized in relation to the viscosity of the medium to provide sufficient braking when the turbine is being driven by compressed air to prevent damage due to overspeeding.

38. A sprinkler as defined in claim 35, wherein the damping member comprises a disc mounted on the shaft within the cavity.

39. A sprinkler as defined in claim 38, wherein:

the fluid inlet is connectable to a source of compressed air when it is desired to purge water from the sprinkler; and

the disc is sized in relation to the viscosity of the medium to provide sufficient braking when the turbine is being driven by compressed air to prevent damage due to overspeeding.

40. A method of operating a gear driven sprinkler including a fluid inlet, a rotatable nozzle head having a water discharge nozzle, a fluid powered motor having an output shaft, a speed reducing drive train rotationally coupled to the output shaft which provides power for rotating the nozzle head, and a dynamic viscous damping mechanism which cooperates with the drive train to apply a braking force, the method comprising the steps of:

connecting the fluid inlet of the sprinkler to a source of water;

driving the motor by directing a portion of the water from the fluid inlet thereto; and

applying a braking force from the viscous damping mechanism which increases non-linearly with increases in the torque supplied by the motor,

the amount of water directed to the fluid motor, and the construction and configuration of the motor being optimized in relation to the braking force applied by the damping mechanism such that a sufficient low speed torque is provided by the

drive train to the nozzle head for reliable and desired rotational speed for the sprinkler nozzle operation.

41. A method as defined in claim 40, wherein the step of operating the fluid motor includes the steps of:

directing the portion of the water to a turbine rotor through a plurality of inlet ports a flow directing stator;

maintaining a desired pressure drop across the inlet ports,

directing water used to drive the rotor to the nozzle head,

the size and number of the inlet ports, and the desired pressure drop in relation to the braking provided by the damping mechanism being such as to provide the desired low speed torque at the nozzle head.

42. A method as defined in claim 41, wherein the braking force is applied by interacting a damping member coupled to the output shaft with a viscous medium in a cavity.

43. A method as defined in claim 42, wherein the damping member is comprised of an enlarged portion which extends longitudinally and radially relative to the shaft in the cavity.

44. A method as defined in claim 42, wherein the damping member is comprised of a disc which extends radially relative to the shaft in the cavity.

45. A method as defined in claim 42, wherein the viscosity of the viscous medium is between about SAE 10 and about SAE 70.

46. A method as defined in claim 42, wherein the viscous medium has a viscosity of about 500 centistokes.

47. A method as defined in claim 42, wherein the viscous medium is a silicone fluid.

48. A method as defined in claim 42, further including the step of connecting the water inlet to a source of compressed air when it is desired to purge water from the sprinkler,

the damping mechanism being configured and dimensioned in relation to the medium viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.

49. A method as defined in claim 40, wherein the braking force is applied by interacting a damping member coupled to the output shaft with a viscous medium in a cavity.

50. A method as defined in claim 49, wherein the damping member is comprised of an enlarged portion which extends longitudinally and radially relative to the shaft in the cavity.

51. A method as defined in claim 49, wherein the damping member is comprised of a disc which extends radially relative to the shaft in the cavity.

52. A method as defined in claim 49, wherein the viscosity of the viscous medium is between about SAE 10 and about SAE 70.

53. A method as defined in claim 49, wherein the viscous medium has a viscosity of about 500 centistokes.

54. A method as defined in claim 49, wherein the viscous medium is a silicone fluid.

55. A method as defined in claim 49, further including the step of connecting the water inlet to a source of compressed air when it is desired to purge water from the sprinkler,

the damping mechanism being configured and dimensioned in relation to the viscosity of the medium to provide sufficient braking when the motor is being driven by compressed air to prevent damage due to overspeeding.